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furnished by the method in which prisms with large refractive angles are used. The method consists essentially in determining the refractive index of a mineral prism enclosed in a highly-refractive medium.—A few years ago Pfaff found that certain regular and uniaxial minerals possessed interfacial angles, which differed from their calculated values by some few minutes. He ascribed this irregularity to the tension producing optical anomalies, but did not show that the crystals measured were optically anomalous.—Brauns¹ has measured isotropic and doubly-refracting lead-nitrate, spinel, and ammonium-alum. He compares the deviations from the true values of the interfacial angles of the isotropic varieties with the deviations noted in the cases of the doubly-refracting varieties, and arrives at the conclusion that a difference between the angles of singly- and doubly-refracting regular crystals does not exist.

BOTANY.²

The National Herbarium.—The botanists of the country have for some years shown an increasing interest in the botanical work of the Department of Agriculture at Washington. This interest has, without question, been of great benefit to the Department, and has probably been the chief factor in calling into existence the "Division of Botany." The Botanical Club of the American Association for the Advancement of Science has doubtless been one of the agents in developing this interest and directing it into useful and effective channels. This work of the club, if it accomplished nothing more, would fully justify its existence.

Now, let the botanists continue their efforts for the advancement of the botanical work in Washington. Let there be a demand for adequate provision for the increase of the Herbarium. There should be an ample appropriation for the investigation and collection of plants in little-known or little-visited localities. It is well known that the Herbarium is wanting in many things which can be obtained only by sending men into the field commissioned to secure certain material. The intelligent and liberal policy of the authorities in respect to the entomological work of the Department, whereby local entomologists in different parts of the country have been set to work for the benefit of the "Division of Entomology," should be imitated on the botanical side. There are many excellent collectors who might be detailed each season to thoroughly explore certain localities at comparatively little expense, while the results would be of vast benefit to the botany of the country.

Some such plan as this must be adopted if anything at all is to be done for botany. The government surveys appear to have

¹ Neues Jahrb. f. Min., 1887, i. p. 138.

² Edited by Prof. CHARLES E. BESSEY, Lincoln, Nebraska.

ceased entirely even the little attention they formerly bestowed upon the plants of the country. Unless the botanists can secure some aid for the Herbarium, systematic botany will suffer grievously in the national capital. While the government is doing so much for science in geological, mineralogical, and anthropological explorations, ought it not to foster also the science of botany, which for its own sake may make equal demands with other sciences, but which may also make special demands because of its close relation to the agricultural interests of the country at large?—*Charles E. Bessey.*

A Duty of Botanists.—Every botanical teacher has in his classes some young men and women who have the desire to become botanists. The number is doubtless relatively small, the great majority in every class taking but a transient interest in botanical science; but as it is from this small number that the working-force of the botanists of the future is to be recruited, these embryo botanists should receive especial attention from teachers.

What should be the preparation of the young man or woman who proposes to enter the field of botany? An examination of a great many college-catalogues shows that in many places there are vague ideas indeed as to what preliminary or supplementary training a botanist should have. In some colleges one might suppose that those in authority imagined botany to be bounded by and included within the ordinary little text-books used in the class-room. I have in mind now some colleges where (as advertised in their catalogues) particular attention is given to botany, and where there are "post-graduate courses of study," leading to the Master's Degree, in which there is no hint whatever that the literature of botany is not all to be found in English books. Not a word of German, no French, no Latin, is indicated as necessary for the young people who pursue even the "post-graduate courses" in botany. Let not the botanists in the better-ordered colleges say that such cases are exceptional. They are not exceptional, as may be easily demonstrated by any one who will take the trouble to examine the catalogues of a considerable number of colleges.

What can a young man do in any department of botany who cannot read German, French, and Latin? The literature of Vegetable Anatomy and Physiology can only be known to him in the meagre translations of men fortunately better trained than himself, while the mass of the literature of systematic botany must forever remain sealed to him, for in this part of the field there are no translations of the great books. What will such a badly-equipped man do with Bentham and Hooker's "Genera Plantarum," DeCandolle's "Prodromus," Walper's "Repertorium," Müller's "Annales," DeCandolle's "Monographiæ Phan-

erogamarum," etc., etc.? Or, suppose he is a student in one of the agricultural colleges, what more fitting subject for him than the thorough study of the grasses, or the injurious fungi? But what can he do in the first case without the ability to use Stendel's "Synopsis Plantarum Graminarum," the works of Kunth, Trinius, Nees, Häckel, or, in the second case, the works of Fries, Persoon, Rabenhorst, Winter, etc.?

There are other grave faults in most of the courses of study in which young botanists are supposed to be getting their training, but this fault of inadequate language preparation is the one perhaps most easily remedied. Should not every teacher of botany use every means possible to bring about a change for the better in this particular? Should not every young botanist be trained in at least the three languages I have mentioned,—German, French, Latin? And is it not the duty of the teachers of botany to see to it that their colleges make provision for such training? Where the authorities will not make such provision, is it not the duty of the teacher of botany to candidly advise the young botanist to go to some other college where necessary preliminary training is not ignored?—*Charles E. Bessey.*

The Element of Time in Botanical Study.—In the arrangement of courses of study it should be borne in mind that the beginner in botany requires more time than is usually allotted to the subject of elementary botany. In fact, it may be said that more time is necessary for botany of any kind or grade than is given to it in ordinary courses of study. In most cases, still, botany occurs as a daily study in the spring term of some school year, often the freshman year in colleges, and this dose (for such it is) is, in many instances, repeated a year or two later. In high schools it is rarely the case that botany receives more time than is afforded by a single spring term.

Now, it must be remembered that botany is a science of observation, and that botanical study on the part of the pupil must consist largely of training and practice in the observation of plants. Nowadays but few teachers are willing to teach botany as a text-book study alone. The pupil is expected to learn about plants by the study and observation of plants rather than by the conning of books. But learning to observe is slow work. One cannot become an observer by simply being told to observe; nor can he become a close observer by a few weeks' hurried practice. A good deal of time is required. The pupil's faculties must have time in which to grow. Just as the learner must have time, extended time, in which to acquire facility in the use of his fingers in performing upon a piano, so he must have time in which to learn to use his eyes in botanical science.

Let our teachers, wherever possible, extend the time devoted to elementary botany so that it will reach through a school year.

Where it is not possible to devote more school time to this science, let the teacher arrange for a year's course with but one or two exercises each week. A pupil who devotes two exercises each week throughout one school year to botany will at the end of that time have a much better and far more enduring knowledge of the subject than if he had devoted five exercises each week to it for a single term. Properly managed, even one exercise each week for a year will bring better results than five exercises a week for one term. Two exercises each week in the fall term, one each week in the winter term, and two a week in the spring term is an arrangement which I have found to work excellently in practice.—*Charles E. Bessey.*

Botanical News.—Sereno Watson's contributions to American Botany, XIV., in the *Proceedings of the American Academy of Arts and Sciences*, vol. xxii. (pp. 396 to 481), consist of (1) a list of plants collected by Dr. Edward Palmer in the State of Jalisco, Mexico, in 1886, and (2) descriptions of some new species of plants. Among the interesting new things are two species of Begonia, one of Zinnia, two of Ipomœa, two of Salvia, five of Aristolochia, two of Habenaria, three ferns (*Acrostichum*, *Notholaena*, and *Cheilanthes*), and three species of *Erythronium*, the latter from Oregon. Three new genera are described,—viz., *Mellichampia* (*Asclepiadaceæ*), *Prochuyanthes* (*Agaveæ*), and *Podistera* (*Umbelliferæ*). The determinations of the Gamopetalæ and the descriptions and notes upon them are by Dr. Gray, the Juncaceæ and Cyperaceæ by Dr. Britton, the Gramineæ by Dr. Vasey, and the Filices by Professor Eaton.—“A Revision of the North American Linaceæ,” by Dr. William Trelease, in *Trans. of the St. Louis Academy of Science*, vol. v. pp. 7 to 20, includes an arrangement and description of all our species of *Linum*, twenty-one in all. The paper is a welcome addition to the literature of systematic botany.—Thomas Meehan has recently read short papers before the Academy of Natural Sciences of Philadelphia upon the following subjects,—viz., “On the Interdependence of Plants,” “On Petiolar Glands in some Onagraceæ,” “Sugar in China,” “Floral Calendars,” and “Cortical Peculiarities in the Plum.”—Professor T. C. Porter has just published (in *Proc. Acad. Nat. Sci. Phil.*) a valuable “List of the Carices of Pennsylvania.”—Part 2 of *Pittonia* has come to hand. It contains much interesting matter, and has a delightful flavor of individuality and originality. The articles of most general interest are those describing the flora of San Miguel, a small island fifty miles west of Santa Barbara.—By the time this number of the NATURALIST reaches its readers the long-promised “Fresh-Water Algæ of the United States,” by Rev. Francis Wolle, will be ready for distribution. It will appear in two volumes, the first consisting of three hundred and sixty-four

pages of text, giving descriptions of species, a glossary, and indices; the second volume contains one hundred and fifty-seven plates, representing over two thousand colored figures. The whole work embraces nearly thirteen hundred species. The price (ten dollars) is remarkably low, when we consider the expensiveness of the colored plates. The work may be obtained of the author at Bethlehem, Pa.

ENTOMOLOGY.¹

Singular Adaptation in Nest-Making by an Ant, *Cremastogaster lineolata*² Say.—A month ago I received an ant's nest, sent by Assistant Engineer Henry A. Brown to General W. G. Lewis, of Goldsboro', N. C. The nest was built several feet from the ground on a bush, in the marshes bordering Broad Creek, Hyde County, N. C.

This ant usually nests "under stones or underneath and within the decayed matter of old logs and stumps. This material is sometimes prepared by the ant as a paper-like pulp, and arranged into cells and chambers, which are attached to the surface of the logs."³

This nest is about eighteen inches long by twelve inches in circumference at greatest diameter. I made a longitudinal section of it, and had a photograph taken, so as to represent both the external form and internal structure. The ants were alive in the nest when I received it. They were chloroformed before sectioning the nest. I took from the nest about one-fourth pint of adults, pupæ, and larvæ. They were collected in a mass through the chambers within a space four inches in length of the nest. This space is about two-thirds the distance from the lower end. The material composing the cells in this space is lighter in color than the other internal parts. It appeared also in the photograph, as can be seen by looking at the right-hand figure. Probably it will be visible in the photoengravure.

The material used in making the nest seems to be the same used by the ant in making its nest under stones, etc. Beside the woody pulp, a microscopic examination seems to reveal also some portions of dried grass. The nest is supported by the branches of the bush; a vine and some stalks of marsh-grass are fastened in it. Upon the outside the material is of a light gray color, much like that of the nest of the white-faced hornet. In the interior it is darker, in some places almost black. Probably the high tides causing the creek to overflow forced the ants to build their nest above the high-water mark instead of under

¹ This department is edited by Prof. J. H. COMSTOCK, Cornell University, Ithaca, N. Y., to whom communications, books for notice, etc., should be sent.

² The ant was determined for me through the kindness of Prof. C. V. Riley.

³ Comstock's Report on Cotton Insects, 1879, p. 188.